

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A water-tolerant, regenerable adsorbent for use in an acid gas dry scrubbing process, said adsorbent comprising surface or framework amine-functionalised mesoporous silica or organosilica, wherein amino groups are readily accessible within the pore channels or pore walls of the mesoporous silica or organosilica.
2. The adsorbent of claim 1, wherein the amine-functionalised mesoporous silica or organosilica comprises amine-containing molecules that are covalently bound to the surface of the pore walls.
3. The adsorbent of claim 2, wherein the amine-containing molecules are amine-containing trialkoxysilane or trichlorsilane.
4. The adsorbent of claim 1, wherein the pore walls of the amine-functionalised mesoporous silica or organosilica has a hydrophobic surface and amine-containing molecules are dispersed within the hydrophobic surface.
5. The adsorbent of claim 4, wherein the amine-containing molecules are alkylamines, arylamines or alkylarylamines.
6. The adsorbent of claim 5, wherein the alkylamines are selected from the group consisting of monoethanolamine (MEA), diethanolamine (DEA), diisopropylamine (DIP), N-methyldiethanolamine (MDEA), 2-amino-2-methyl-1-propanol (AMP), polyethylenimine, β,β' -hydroxyaminoethylether and combinations thereof.
7. The adsorbent of claim 1, wherein the mesoporous silica or organosilica comprises an amine-functionalised framework.
8. The adsorbent according to any one of claims 1 – 7, wherein the acid gas is carbon dioxide.

9. A method of dry scrubbing comprising the step of contacting a gaseous stream containing an acid gas to be removed with water-tolerant, regenerable adsorbent comprising surface or framework amine-functionalised mesoporous silica or organosilica, wherein amino groups are readily accessible within the pore channels or pore walls of the mesoporous silica or organosilica.
10. The method according to claim 9, wherein the amine-functionalised mesoporous silica or organosilica comprises amine-containing molecules that are covalently bound to the surface of the pore walls.
11. The method according to claim 9, wherein the pore walls of the amine-functionalised mesoporous silica or organosilica has a hydrophobic surface and amine-containing molecules are dispersed within the hydrophobic surface.
12. The method according to claim 9, wherein the mesoporous silica or organosilica comprises an amine-functionalised framework.
13. A process for preparing an adsorbent according to claim 2 or 3, comprising:
 - (a) providing a mesoporous silica or organosilica; and
 - (b) grafting an amine-containing silane to the surface of the mesoporous silica or organosilica to produce the amine-functionalised mesoporous silica or organosilica.
14. A process for preparing an adsorbent according to claim 2 or 3, comprising:
 - (a) mixing a source of silica or organosilica, an amine-containing silane and an amphiphile molecule under conditions that facilitate self assembly to produce the amine-functionalised mesoporous silica or organosilica.
15. A process for preparing an adsorbent according to claim 2 or 3, comprising:
 - (a) providing a mesoporous silica or organosilica;
 - (b) grafting an reactive group-containing silane to the surface of the mesoporous silica or organosilica; and
 - (c) treating the reactive group-containing mesoporous silica or organosilica with an amine to produce the amine-functionalised mesoporous silica or

organosilica.

16. A process for preparing an adsorbent according to claim 2 or 3, comprising:
 - (a) mixing a source of silica or organosilica, a reactive group-containing silane and an amphiphile molecule to produce the reactive group-containing mesoporous silica or organosilica; and
 - (b) treating the reactive group-containing mesoporous silica or organosilica with an amine to produce the amine-functionalised mesoporous silica or organosilica.
17. A process for preparing an adsorbent according to any one of claims 4, 5 or 6, comprising:
 - (a) preparing a mesoporous silica or organosilica in the presence of a swelling agent and selectively extracting the swelling agent to produce a hydrophobic layer on the surface of the mesoporous silica or organosilica; and
 - (b) treating the mesoporous silica or organosilica produced in step (a) with an amine to produce the amine-functionalised mesoporous silica or organosilica.
18. A process for preparing an adsorbent according to claim 1, comprising:
 - (a) mixing a silica source with an amphiphilic molecule having at least one amino group under conditions that facilitate self assembly of the silica source and the amphiphile to produce the amine-functionalised mesoporous silica or organosilica,wherein, the amine-functionalised mesoporous silica or organosilica is a mesoporous silica or organosilica having pores filled with amine-containing amphiphilic molecules.
19. A process for preparing an adsorbent according to claim 1, comprising:
 - (a) reacting a silica source with an amphiphilic molecule; and
 - (b) simultaneously or subsequently adding an amine-containing swelling agent.
20. A process for preparing an adsorbent according to claim 7, comprising:

- (a) mixing a reactive group-containing silica source with an amphiphilic molecule to produce a mesoporous silica or organosilica having a framework comprising reactive sites; and
 - (b) introducing amino groups at the reactive sites to produce the amine-functionalised mesoporous silica or organosilica.
21. A system for removal of an acid gas from a gaseous stream, comprising:
- (a) two or more sorbent beds comprising the adsorbent of claim 1;
 - (b) valve means for controlling gas flow through the sorbent beds; and;
 - (c) pump means for controlling gas pressure in the system.
22. The system according to claim 21, wherein the acid gas is carbon dioxide.
23. The system according to claim 21 or 22, wherein the adsorbent is pelletized with a binder that is an inert secondary material.
24. The system according to claim 21 or 22, wherein the adsorbent is pelletized with a binder that is an active secondary material.